Summary of Pygmy Whitefish Capture Effort: Cedar River near Camp 18 Bridge December 2006

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1.0 **Introduction**

Seattle Public Utilities (SPU) manages the Cedar River Municipal Watershed (CRMW) under the Cedar River Watershed Habitat Conservation Plan (CRW-HCP, City of Seattle 2001). One project in the HCP requires SPU to design and implement studies exploring life history characteristics of pygmy whitefish. These studies are important to gain a better understanding of the overall lake ecology as pygmy whitefish are a major food source for adfluvial bull trout in Chester Morse Lake, one of the City of Seattle's main reservoirs. Pygmy whitefish, a small pelagic fish, annually migrate into major river tributaries of Chester Morse Lake to spawn.

In 2006, we initiated preliminary work on the pygmy whitefish HCP studies to help scope future pygmy whitefish studies as outlined in the CRW-HCP. One component of the suite of HCP mandated fisheries studies includes a study exploring habitat use of bull trout, rainbow trout and pygmy whitefish in Chester Morse Lake. An acoustic telemetry array of hydrophones was established in late 2005 to track fish as they moved within the reservoir complex. During late 2006, we implanted acoustic tags in pygmy whitefish to start collecting movement data for the species in Chester Morse Lake.

Our initial effort focused on capturing pygmy whitefish from spawning schools in the Cedar River. The fish are most abundant upstream of the Camp 18 Bridge and therefore we focused in this reach of the river. On December 7th and 11th, crews seined over 450 pygmy whitefish from schools located upstream of the Camp 18 Bridge. The fish were held in a live car and buckets during handling. We had several objectives for our preliminary work as listed below.

- Find the most efficient way to capture pygmy whitefish from spawning schools
- Determine how pygmy whitefish respond to handling and tagging
- Attempt to implant acoustic tags in pygmy whitefish to track movement in Chester Morse Lake
- Attempt to implant PIT (passive integrated transponders) tags as a unique marker in pygmy whitefish
- Collect scale samples and otoliths for future age analysis
- Collect 20 fish for a Department of Ecology heavy metals study

2.0 Acoustic Tagging

Fifteen acoustic tags (V7 model) were purchased from Vemco, Inc. for this project in late 2005, 14 of which were used in fish. A hydrophone array, already in place for a bull trout and rainbow trout movement study, provided the ability to monitor habitat use and movement of pygmy whitefish once they returned to Chester Morse Lake. The battery life of the V7 acoustic tags supplied by Vemco ranges between 165 and 250 days. The tag "ping" frequency is set to send a signal every 60-180 seconds. We expect to track some of the 14 pygmy whitefish into the late summer 2007 with tags.

Surgery on pygmy whitefish was performed by Eric Jeanes, R2 Resource Consultants. He found he did not need to anesthetize fish for the procedure and minimal suturing was required to close the small incision for the V7 acoustic tags. All fish survived the procedure and were held for twenty-four hours in a live well to assess their condition before release. All fish appeared vigorous the following day when released back to the school where they were collected.

Three of the fourteen tagged fish were male, five were female, and the sex of six was unknown. All fish originated from a school located 140 meters upstream of the Camp 18 Bridge on the Cedar River. Fork length ranged between 168 mm and a maximum of 200 mm (mean = 179 mm).

3.0 PIT (Passive integrated transponder) tagging

A juvenile bull trout and rainbow trout movement study was initiated in 2005 in a collaborative effort between USGS and SPU. A PIT tag detector installed downstream of the Camp 18 Bridge on the Cedar River records passage time for each tagged fish as it moves through the array. Although pygmy whitefish only migrate into the river for a brief time, we tagged a small set of fish to see how many might return in the following spawning run. This tagging effort was considered preliminary in nature. Collecting a large number of fish allowed us to gather information to characterize the size distribution of individuals in the spawning population.

PIT tags were implanted in fish on two separate dates (12/7 and 12/11). We measured length and weight for all fish as well as collected sex information on fish. Most fish were easy to sex as they were extremely ripe and eggs or milt was readily visible when fish were handled. Others however were not easy to sex and we guessed or if extremely unsure, placed them in an unknown category.

A total of 424 pygmy whitefish received PIT tags from six different schools in the Cedar River. Schools were located at 8 meters, 152 meters, 200 meters, 230 meters, 556 meters, and 624 meters upstream of the Camp 18 Bridge (Figure 1, Table 1). On December 7th, 227 pygmy whitefish were tagged from the 140 meter school. We collected a random grab sample out of each school and found that the proportion of females to males was skewed towards males in each school. The highest percentage of females came from the school 556 meters upstream of Camp 18 Bridge with 38% of the sample identified as female. The lowest percentage of females was 14% from the 200 meter school where over half of our tagged population was collected. We hoped to capture fish on one additional day to determine if the proportion of males to females changed temporally through the spawning run, but were unable to do this due to high flows.

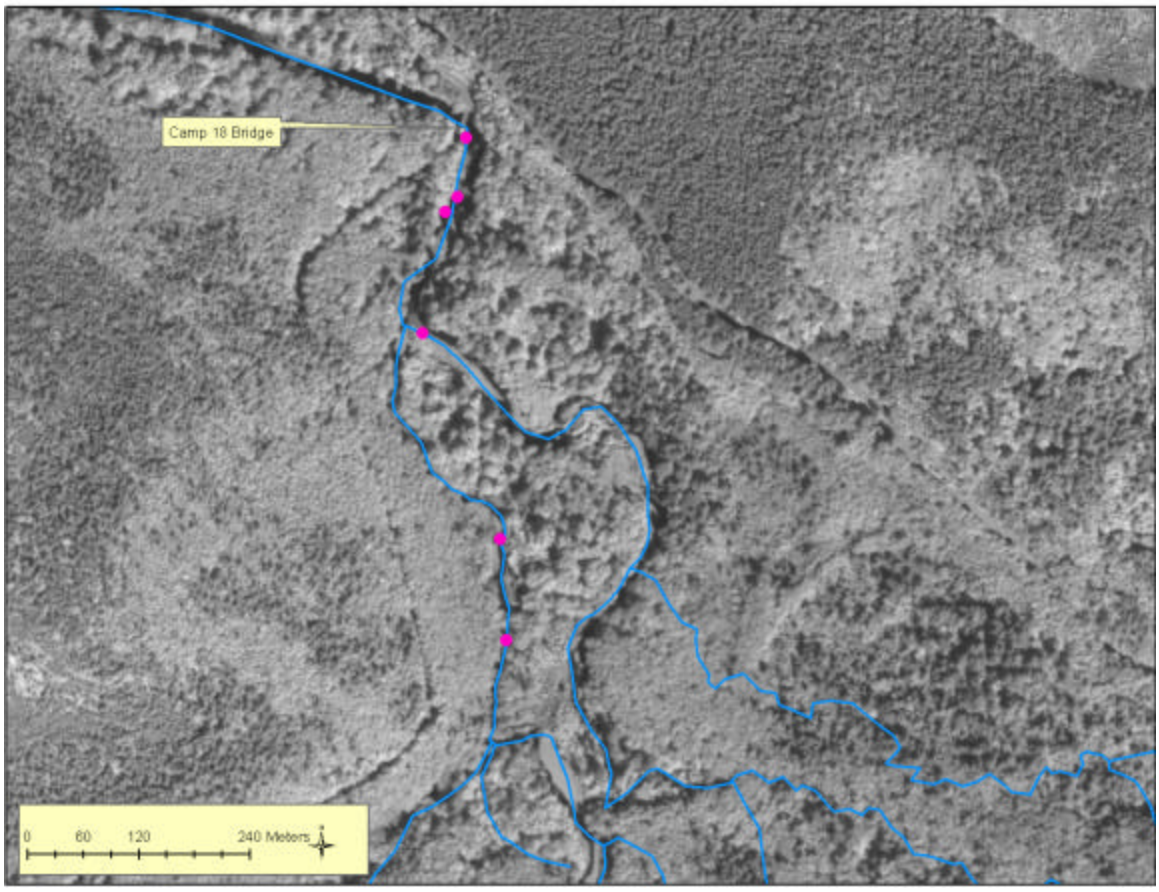


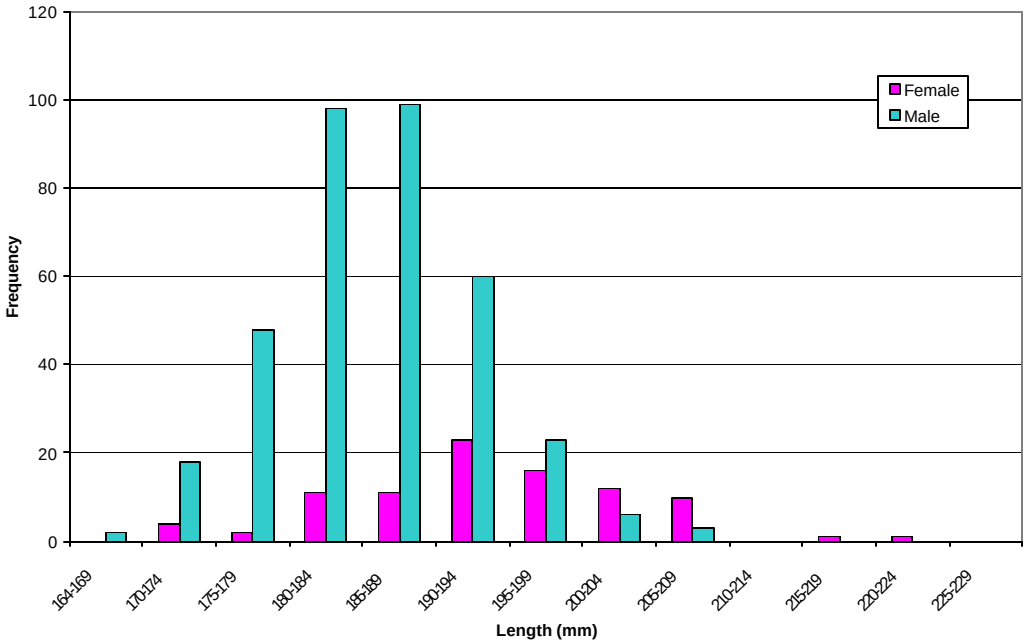
Figure 1. Location of pygmy whitefish capture sites on the Cedar River, December 2006.

Table 1. Number of females and males collected during December 2006 pygmy whitefish spawning run.

Location	*Female confirmed*	*Female guess*	*Male confirmed*	*Male guess*	*Unknown Sex*	**Total**
8 m	4	3	33	1		41
152 m	2	2	24	1		29
200 m	17	14	170	13	13	227
230 m	8	6	29	3		46
556 m	9	6	23	2		40
624 m	5	3	31	2		41
TOTAL						424

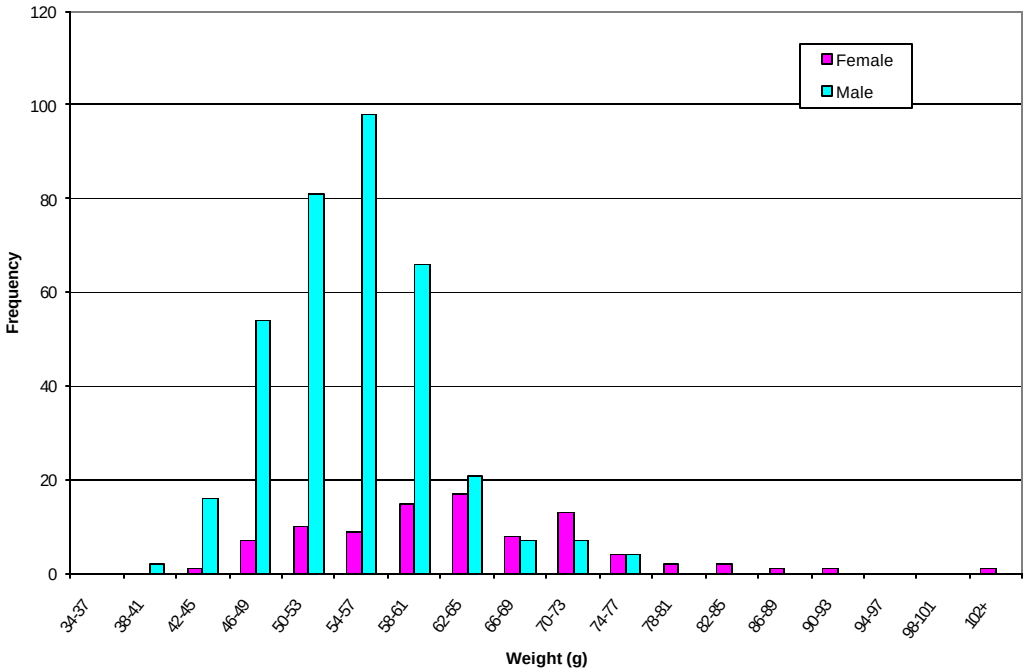
Fork lengths of pygmy whitefish ranged between 169mm and 224mm. Fish from all schools appeared to be the same size and no significant size difference between schools was observed. In general, females tended to be slightly larger than males. Most males measured between 180mm and 189mm (Figure 2). Only 17% of pooled females measured less than 180mm, while 46% of all males measured less than 180mm.

Figure 2. Length distribution of female and male pygmy whitefish collected in the Cedar River during December 2006.



Weights of pygmy whitefish ranged between 42.0 and 98.1g for females and 34.5 and 73.5g for males (Figure 3). Males showed the least variation in weight as females vary in the number and condition of eggs they carry.

Figure 3. Weight distribution of female and male pygmy whitefish collected in the Cedar River during December 2006.



4.0 Observations on Handling Pygmy Whitefish

Seining pygmy whitefish from spawning schools was an easy task. The Cedar River is a low gradient system (1-2% through the spawning reach of pygmy whitefish) with a bankfull width of approximately 24-30 meters. While pools are relatively deep, pygmy whitefish schools tend to aggregate in glide and shallow pool habitat. These areas are easily wadeable and three to four people working together can herd the school towards the seine net. Once fish swam over the net, they were collected and held in several buckets before processing. We noted that water became increasingly murky, likely due to male spawning activity in the bucket. Ripe females would spill some eggs when tagged. We expect that this likely encouraged male spawning activity as well. Fish were processed quickly and returned to the school where collected. We had no mortality of any captured or handled pygmy whitefish. The handling process is documented in the "Photos" section at the end of this summary.

5.0 Collection of scale samples, DNA and Otoliths

Scale samples were collected from all acoustic tagged fish, from 20 pygmy whitefish given to the Department of Ecology, and from 29 fish collected for otoliths. We will have the scales mounted and read during 2007 to get a better idea of age within the spawning population sampled. Three scales from acoustic tagged fish were mounted by R2 Resources and they determined fish aged between four and five years (Figure 4, 5 and 6).

DNA fin clip samples were collected from 20 fish for researchers in Canada. These samples will be used to assess genetic relationships of the morphological "giant" pygmy whitefish, of which Chester Morse Lake are considered, to other pygmy whitefish throughout their range. Fin clips were also collected from all acoustic tagged fish and preserved for future reference if desired.

Figure 4. CM-56a (provided by R2 Resource Consultants).

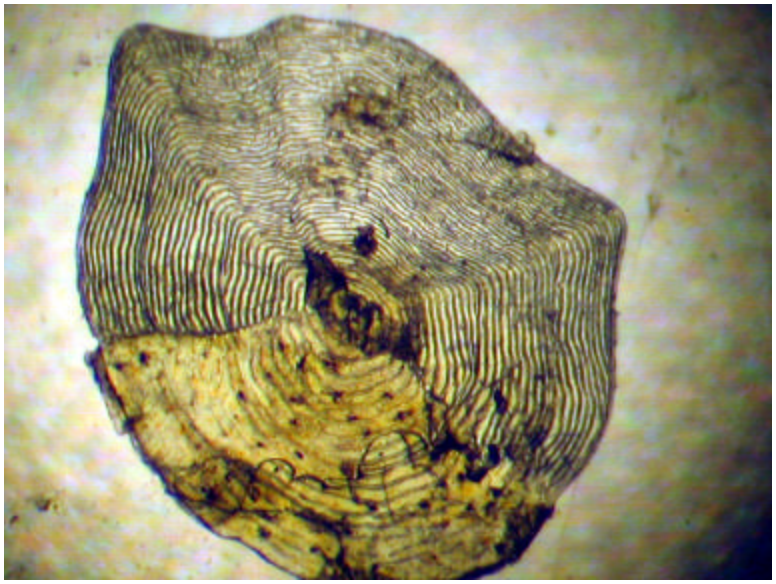


Figure 5. CM-56b (provided by R2 Resource Consultants).

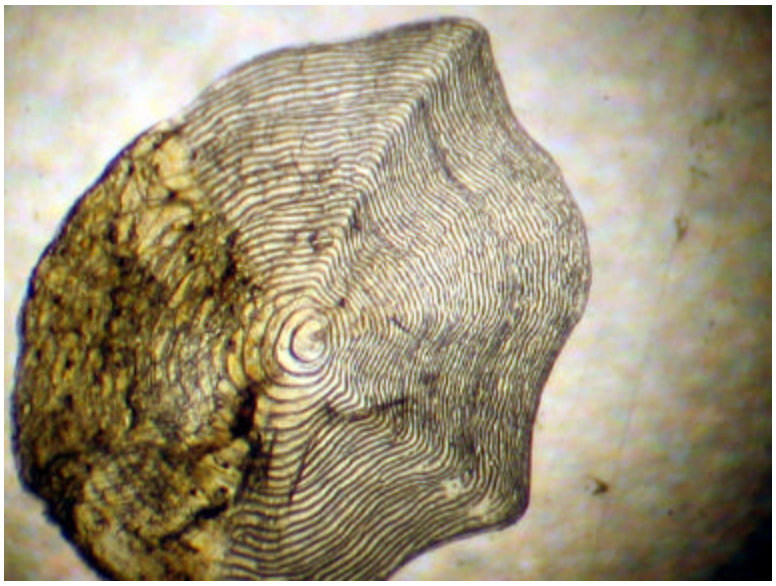


Figure 6. CM-56c (provided by R2 Resource Consultants).

6.0 Photos

Photo 1. Pygmy whitefish school 450' upstream of Camp 18 Bridge.

Photo 2. Netting pygmy whitefish.

Photo 3. Pygmy whitefish in live car.

Photo 4. V7 acoustic tags implanted in pygmy whitefish.

Photo 5. Eric Jeans performs surgery to implant acoustic tag.

Photo 6. PIT tagging pygmy whitefish.

Photo 7. PIT tagging pygmy whitefish.

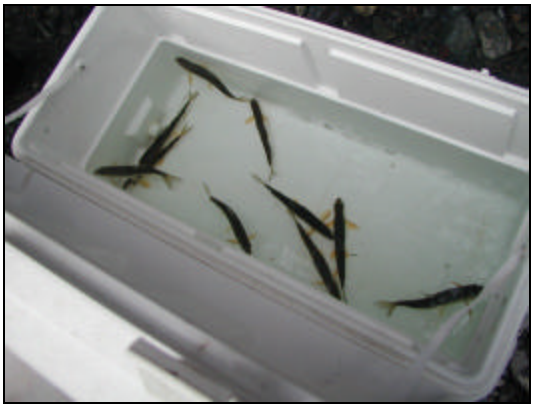


Photo 8. Pygmy whitefish recovery bucket.